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The fluctuating topography and acceleration statistics in a turbulent channel flow JOHN CHIRISTOS VASSILICOS, LU CHEN, Imperial College London, ZHIWEI HU, University of Southampton — Dallas, Vassilicos & Hewitt (PRE, 2009) characterised the turbulent channel flow topography of the fluctuating velocity field in terms of its stagnation points and quantified this topography by observing that, in the intermediate layer, the number density of stagnation points is inversely proportional to wall-distance. Our DNS of turbulent channel flow confirm this observation at skin friction Reynolds numbers 360 and 720. This spatial structure of the fluctuating velocity's topography partly determines the mean flow profile. We then study, in the intermediate layer, the motion of stagnation points which depends on the acceleration field. The mean streamwise acceleration equals the square of the skin friction velocity divided by the half width, the mean spanwise acceleration is zero and the mean wall-normal acceleration equals the vertical gradient of the mean square vertical fluctuating velocity. The local and convective acceleration terms tend to cancel each other and their rms values are equal only if the terms involving products of mean and fluctuating velocity terms are taken into account. When these terms are excluded, the rms of all three acceleration components are inversely proportional to wall-distance. Consequently,the rms of the streamwise stagnation point velocity is inversely proportional to wall-distance but the rms of this velocity's two other components are independent of it.

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